

CLAIMS

I claim:

- [c1] 1. A testing system for testing a packaged microfeature device having a profile and an array of electrical contacts, comprising:
- a socket carried by a circuit board and having an array of leads configured to contact the array of contacts on the packaged device at a reference plane; and
- a package handling assembly having a placement head and an alignment element coupled to the placement head, the placement head being moveable between a first position at which the alignment element is separated from the socket and a second position at which the alignment element is proximate to the array of leads of the socket, the alignment element having an alignment portion configured to guide lateral movement of the packaged device in the reference plane relative to the array of leads.
- [c2] 2. The system of claim 1 wherein the alignment portion comprises a channel having projections sized and shaped to engage a perimeter of the packaged device.
- [c3] 3. The system of claim 1 wherein the alignment element has sidewalls defining an alignment aperture through which the packaged device can pass along a load/unload path, and wherein the sidewalls are configured to restrict movement of the packaged device lateral to the load/unload path.
- [c4] 4. The system of claim 1 wherein the alignment element comprises a tapered chamber having inclined sidewalls that slope inwardly and downwardly.

- [c5] 5. The system of claim 1 wherein the alignment element is detachable from the placement head.
- [c6] 6. The system of claim 1 wherein the package handling assembly and the socket are movable in at least three dimensions relative to each other.
- [c7] 7. The system of claim 1 wherein the package handling assembly is an automated assembly.
- [c8] 8. The system of claim 1 wherein the alignment element is a first alignment element, and further comprising a second alignment element interchangeable with the first alignment element on the package handling device, the second alignment element having a second alignment portion configured to receive a second packaged device having a profile different than the first packaged device in a manner that guides lateral movement of the second packaged device relative to the array of leads.
- [c9] 9. The system of claim 1 wherein the socket is a first socket, and further comprising a plurality of other sockets connected to the testing substrate and substantially identical to the first socket, the alignment element being positionable in the receiving areas of the plurality of other sockets.
- [c10] 10. The system of claim 1, further comprising guide connected to the socket in the receiving area, the guide positioned to support the packaged device a fixed distance from the array of leads.
- [c11] 11. The system of claim 1, further comprising a guide plate connected to the socket adjacent to the array of leads and positioned to support the packaged device a fixed distance from the array of leads.

[c12] 12. A system for testing a plurality of packaged microfeature devices having electrical contact, the packaged devices having at least one of a plurality of profiles, comprising:

a plurality of sockets arranged in a socket array, wherein individual sockets have an array of leads coupleable to the array of contacts on the packaged devices, at least one of the sockets being a first socket having a receiving area proximate to the array of leads and configured to removably receive a respective a packaged device independent of the package profile of the packaged device; and

a package handling assembly having a support member and a plurality of alignment elements carried by the support member, at least one of the alignment elements being a first alignment element that is moveable with the support member as a unit relative to the first socket to be positioned in the receiving area of the first socket, the first alignment element having portions configured to restrict movement of a packaged device in at least two dimensions relative to the first socket when the packaged device is positioned in the receiving area.

[c13] 13. The system of claim 12 wherein the first alignment element is removably connected to the support member.

[c14] 14. The system of claim 12 wherein the first alignment element has sidewalls that define an alignment aperture corresponding to the one of the package profiles.

[c15] 15. The system of claim 12 wherein the package handling assembly and the plurality of sockets are movable in at least three dimensions relative to each other.

[c16] 16. The system of claim 12 wherein the package handling assembly is an automated assembly.

[c17] 17. A testing system for testing a packaged microfeature device having a profile and an array of contacts, comprising:

a socket having an array of leads configured to contact the array of contacts on the packaged device at a reference plane; and

a package handling assembly having a placement head and an alignment element coupled to the placement head, the placement head and alignment head being moveable relative to the socket, the alignment element having an aperture therethrough with internal tapered bearing surfaces terminating at an opening and configured to align the array of contacts of the packaged device with the array of leads in the socket.

[c18] 18. The system of claim 17 wherein the alignment element has external bearing surfaces configured to align the alignment element relative to the array of leads.

[c19] 19. The system of claim 17 wherein the internal tapered bearing surface slope inwardly and downwardly.

[c20] 20. The system of claim 17 wherein the alignment element is detachable from the placement head.

[c21] 21. The system of claim 17 wherein the alignment element is a first alignment element, and further comprising a second alignment element interchangeable with the first alignment element on the package handling device, the second alignment element having a second alignment portion configured to receive a second packaged device having a profile different than the first

packaged device in a manner that guides lateral movement of the second packaged device relative to the array of leads.

[c22] 22. A testing system for testing a packaged microfeature device having a profile and an array of electrical contacts, comprising:

a means for testing the packaged device, the means for testing having an array of engagement means for contacting the array of contacts on the packaged device at a reference plane; and

a handling means for handling packaged devices, the handling means having a placement means and a means for aligning the packaged device laterally relative to the reference plane, the placement means being moveable between a first position at which the means for aligning is separated from the means for testing and a second position at which the means for aligning is proximate to the array of engagement means of the means for testing, the means for aligning configured to guide lateral movement of the packaged device in the reference plane relative to the array of engagement means.

[c23] 23. The system of claim 22 wherein the means for aligning comprises a channel having means to support the packaged device, the means to support being sized and shaped to engage a perimeter portion of the packaged device.

[c24] 24. The system of claim 22 wherein the means for aligning has bearing surfaces that allow movement of the packaged device along a load/unload path and configured to restrict movement of the packaged device lateral to the load/unload path.

[c25] 25. The system of claim 22 wherein the means for aligning is detachable from the placement means.

[c26] 26. The system of claim 22 wherein the handling means and the testing means are movable in at least three dimensions relative to each other.

[c27] 27. A testing system for a packaged microfeature device having a profile and an array of electrical contacts, comprising:

- a socket carried by a testing substrate and having an array of leads coupleable to the array of contacts and a receiving area proximate to the array of leads that is configured to removably receive the packaged device therein;

- a surface guide coupled to at least one of the socket and the packaged device, the surface guide positioned to support at least a portion of the body apart from the array of leads, with the array of contacts in alignment with the array of leads; and

- a package handling assembly movable between a load position and a release position relative to the socket, the package handling assembly having an alignment element configured to contact a perimeter edge of the packaged device in a manner that aligns the contacts with corresponding leads at the receiving area profile in at least two dimensions relative to the socket.

[c28] 28. The system of claim 27 wherein the surface guide is removably connected to the socket.

[c29] 29. The system of claim 27 wherein the surface guide is integral with a component of the socket.

[c30] 30. The system of claim 27 wherein the surface guide includes an aperture therein sized receive the array of contacts independent of the package profile.

- [c31] 31. The system of claim 27 wherein the receiving area of the socket is sized to receive the packaged device therein with the array of contacts in direct alignment with the array of leads independent of the package profile of the body.
- [c32] 32. The system of claim 27 wherein the alignment element is shaped and sized to at least substantially correspond to the package profile of the body.
- [c33] 33. The system of claim 27 wherein the alignment element has sidewalls defining an alignment aperture through which the packaged device can pass along a load/unload path, and wherein the sidewalls are configured to restrict movement of the packaged device lateral to the load/unload path.
- [c34] 34. The system of claim 27 wherein package handling assembly has a support member and the alignment element is removably coupled to the support member.
- [c35] 35. The system of claim 27 wherein the alignment element comprises a tapered chamber having inclined sidewalls that slope inwardly and downwardly.
- [c36] 36. The system of claim 27 wherein the package handling assembly is an automated assembly.
- [c37] 37. The system of claim 27 wherein the alignment element is a first alignment, and further comprising a second alignment element interchangeable with the first alignment element on the package handling device, the second alignment element having a second alignment portion configured to receive a second packaged device having a profile different than the first packaged device in a manner that guides lateral movement of the second packaged device in the reference plane relative to the array of leads.

[c38] 38. The system of claim 27 wherein the socket is a first socket, and further comprising a plurality of other sockets connected to the testing substrate and substantially identical to the first socket, the alignment element being positionable in the receiving areas of the plurality of other sockets.

[c39] 39. A packaged device testing system for testing first and second packaged devices, the first packaged device having a first array of contacts and having a first package profile, and the second packaged device having a second array of contacts substantially the same as the first array of contacts and having a second package profile different than the first package profile, comprising:

a socket having an array of leads arranged to be coupleable with the first and second array of contacts, the socket having a receiving area adjacent to the array of leads and configured to removably receive the first and second packaged devices; and

a surface guide coupled to the socket and positioned to support one of the first and second packaged devices apart from the array of leads with the array of leads being in alignment with one of the first and second array of contacts.

[c40] 40. The system of claim 39 wherein the array of leads are configured to contact the first or second array of contacts at a reference plane, and further comprising a package handling assembly having a placement head and an alignment element coupled to the placement head, the placement head being moveable between a first position at which the alignment element is separated from the socket and a second position at which the alignment element is proximate to the array of leads of the socket, the alignment element having an alignment portion configured to guide lateral movement of the first or second packaged devices in the reference plane relative to the array of leads.

[c41] 41. The system of claim 39, further comprising a package handling assembly movable relative to the socket, the package handling assembly having

an alignment element positionable in the receiving area of the socket, the alignment element restricting lateral movement of the first or second package profiles in at least two dimensions relative to the socket.

[c42] 42. The system of claim 39 wherein the array of leads are configured to contact the first or second contacts at a reference plane, and further comprising:

a first alignment element shaped to receive the first packaged device and being positionable in the receiving area of the socket, the first alignment element configured to guide lateral movement of the first packaged device in the reference plane relative to the array of leads; and

a second alignment element shaped to receive the second packaged device and being positionable in the receiving area of the socket, the second alignment configured to guide lateral movement of the second packaged device in the reference plane relative to the array of leads.

[c43] 43. The system of claim 39 wherein the surface guide is removably connected to the socket.

[c44] 44. The system of claim 39 wherein the surface guide includes an aperture sized to independently receive the first and second arrays of contacts independent of the first and second package profiles.

[c45] 45. The system of claim 39 wherein the surface guide includes at least one engagement member positioned to temporarily engage at least one of the first and second arrays of contacts during removal of the respective first or second packaged devices from the socket.

[c46] 46. The system of claim 39 wherein the receiving area of the socket is sized to independently receive the first and second packaged devices therein with

the respective first and second arrays of contacts in direct alignment with the array of leads independent of the first and second package profiles.

[c47] 47. The system of claim 39 wherein the socket is a first socket, and further comprising a plurality of other sockets substantially identical to the first socket.

[c48] 48. A packaged device testing apparatus for testing first and second packaged devices having commonly arranged arrays of contacts, the first packaged device having a first package profile and the second packaged device having a second package profile different from the first package profile, comprising:

- a socket having an array of leads arranged to be coupleable with the commonly arranged array of contacts, the socket having a receiving area adjacent to the array of leads and configured to removably receive the first and second packaged devices independent of the first and second package profiles; and

- a surface guide coupled to the socket and positioned to engage a respective one of the first and second packaged devices independent of the first and second package profiles and to support the respective one of the first and second packaged devices away from the support surface with the array of leads being in direct alignment with the array of contacts of the respective one of the first and second packaged devices.

[c49] 49. The apparatus of claim 48 wherein the surface guide is removably connected to the socket.

[c50] 50. The apparatus of claim 48 wherein the surface guide has a retention member releasably engaging the socket and retaining the surface guide in a substantially fixed position on the socket.

[c51] 51. The apparatus of claim 48 wherein the surface guide is integrally connected to the socket.

[c52] 52. The apparatus of claim 48 wherein the surface guide includes an aperture therein sized to independently receive the array of contacts of the first and second packaged devices independent of the first and second package profiles.

[c53] 53. The apparatus of claim 48 wherein the surface guide includes at least one engagement member positioned to block at least one of the first and second packaged devices from moving laterally relative to the receiving area.

[c54] 54. A method of testing a packaged device having an array of contacts and a package profile, comprising:

positioning an alignment element in a socket having an array of leads couplable to the array of contacts at a reference plane;
positioning the packaged device in the alignment element with the array of contacts of the packaged device in alignment with an array of leads in the socket;
restricting lateral movement of the packaged device relative to the reference plane;
connecting the packaged device to the socket with the array of contacts coupled to the array of leads;
removing the alignment element from the socket without removing the packaged device from the socket; and
testing the packaged device in the socket.

[c55] 55. The method of claim 54, further comprising positioning a body of the packaged device apart from the array of leads along an axis normal to the reference plane when the packaged device is connected to the socket.

[c56] 56. The method of claim 54 wherein testing includes burn-in testing of the packaged device.

[c57] 57. The method of claim 54 wherein positioning a packaged device includes positioning the packaged device in a placement head of an automated package handling system.

[c58] 58. The method of claim 54, further comprising positioning a surface guide on the socket adjacent to the array of leads before the alignment element and packaged device are positioned as a unit in the socket, and spacing the packaged device from the array of lead with the surface guide.

[c59] 59. The method of claim 54 wherein the packaged device is a first packaged device having a first package profile and the alignment element is a first alignment element, and further comprising:

- removing the first packaged device from the socket;
- positioning a second alignment element in the socket, the second packaged device having a second array of contacts and a second package profile different from the first package profile;
- positioning a second packaged device in the second alignment element with a second array of contacts of the second packaged device in direct alignment with an array of leads in the socket;
- restricting lateral movement of the second packaged device relative to the reference plane;
- connecting the second packaged device to the socket with the second array of contacts coupled to the array of leads;
- removing the second alignment element from the socket without removing the second packaged device from the socket; and
- testing the second packaged device in the socket.

[c60]

60. A method of testing first and second packaged devices, the first packaged devices having common first arrays of contacts and common first package profiles, and the second packaged devices having common second arrays of contacts and common second package profiles different from the first package profiles, comprising:

loading the first packaged devices in the sockets through a set of first alignment elements, the set of first aligning elements laterally aligning the first package profiles relative to respective reference planes;

coupling the first arrays of contacts of the first packaged devices with arrays of leads in the sockets at the respective reference planes;

removing the set of first alignment elements from the sockets without removing the first packaged devices from the sockets;

testing the first packaged devices;

removing the first packaged devices from the sockets;

replacing the set of first alignment elements with a set of second alignment elements;

loading the second packaged devices in the sockets through the set of second alignment elements, the set of second aligning elements laterally aligning the second package profiles relative to the respective reference planes;

coupling the second arrays of contacts of the second packaged devices with the arrays of leads in the sockets at the respective reference planes;

removing the set of second alignment elements from the sockets without removing the second packaged devices from the sockets; and

testing the second packaged devices.

[c61]

61. The method of claim 60, further comprising positioning the first packaged devices apart from the arrays of leads along axes normal to the reference planes when the first packaged devices are connected to the sockets.

[c62] 62. The method of claim 60 wherein testing includes burn-in testing of the first and second packaged devices.

[c63] 63. The method of claim 60, further comprising positioning a surface guides on the sockets adjacent to the arrays of leads before the set of first alignment elements and the first packaged devices are positioned in the sockets, and spacing the first packaged devices from the arrays of leads with the surface guides.

[c64] 64. The method of claim 60 wherein loading the first packaged devices in the sockets includes passing the first packaged devices through alignment apertures having tapered bearing surfaces terminating at openings through which the set of first alignment elements can pass along load/unload paths, the tapered bearing surfaces restricting movement of the set of first aligning elements lateral to the load/unload paths.

[c65] 65. The method of claim 60 wherein loading the second packaged devices in the sockets includes passing the second packaged devices through alignment apertures having tapered bearing surfaces terminating at openings through which the set of second alignment elements can pass along load/unload paths, the tapered bearing surfaces restricting movement of the set of first aligning elements lateral to the load/unload paths.